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Impact of Pressure–Gradient Conditions on High Reynolds Number Turbulent Boundary Layers

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Mean velocity distributions in the overlap region, over the range 10,000 < ReTheta < 70,000, under five different pressure-gradient conditions are accurately described by a log law. The pressure-gradient conditions include adverse, zero, favorable and strongly favorable. The wall-shear stress was measured using oil-film interferometry, and hot-wire sensors were used to measure velocity profiles. Parameters of the logarithmic overlap region developed from these higher Reynolds number boundary layers continue to be consistent with our recent findings and to remain independent of Reynolds number. The best estimate of the log-law parameters from the zero-pressure gradient boundary layers is Kappa = 0.38, B = 4.1. However, the Karman coefficient (Kappa) is found to vary considerably for the non-equilibrium boundary layers under the various pressure gradients. Variations with pressure gradient are not only in the outer region of the boundary layer but also within the inner region.

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